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ABSTRACT

Significant relations were found in this study between how teachers teach and how much children learn in reading and mathematics. The general picture which emerged from the data had two features; first, a pattern of teaching practices is more likely to be related to learning than a single practice and, second, effective teaching patterns will differ by subject matter and by grade level. The second of these conclusions is an important one if replicated. The conclusion implies that the goals of training teachers in the primary grades and the intermediate grades and for different subject areas will be necessarily different. Perhaps the most important general conclusion from the study is that teachers do make a difference in how well their pupils learn. In this as in other studies the skills a pupil brought to the classroom were a large determinant of how much he learned. But when the entry-level skills of pupils were "accounted for" statistically, the remaining differences in pupil learning were almost all accounted for by differences among teachers in how they taught. (RC)

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PR-76-17

BEGINNING TEACHER EVALUATION STUDY
PHASE II 1973-74

SUMMARY REPORT

BY

FREDERICK J. McDONALD

EDUCATIONAL TESTING SERVICE
PRINCETON, NEW JERSEY

BEGINNING TEACHER EVALUATION STUDY: PHASE II

SUMMARY REPORT

by

Frederick J. McDonald

Educational Testing Service
Princeton, New Jersey

A study conducted by Educational Testing Service for the California Commission for Teacher Preparation and Licensing and funded by the National Institute of Education.

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Preface

The study reported here found significant relations between how teachers teach and how much children learn in reading and mathematics. These findings should be treated with caution. They have been developed by observing a relatively small sample of teachers. The results might be different with a new sample. The relations between teaching and learning reported here pertain only to those that were measured in this study. Other characteristics of teaching might be important for other kinds of learning.

Those characteristics of teaching found to be more effective in this study should not be used to evaluate teachers because at most they describe differences in degrees of effectiveness. They do not describe the differences between competence and incompetence. The teachers who participated in this study were experienced; the children in their classes improved in reading and mathematics to different degrees. Differences in teaching accounted for some of the differences in learning over the year.

This study contributes to our understanding of how to help children learn more, understand more, and become more skillful. It also describes teaching practices which are less effective, but the study does not provide criteria for evaluating incompetence.

In brief, the achievement of this study was specifically that it did find teaching effects. It verified that some performances or procedures produced learning in second and fifth grade classes studying reading and mathematics and that some classes learned more than others because their teachers used effective techniques more frequently than the other teachers did.

The full report of this study is available in five volumes from Educational Testing Services, Princeton, New Jersey, 08540. Volume I is a description of the design, rationale, results of data analyses and major conclusions. Volume II describes the conduct of the field study in which the data were gathered. Volume III describes the observational systems in detail, and Volume IV the other aspects of the measurement system. Volume V, which is bound in five sections, describes the teacher aptitude battery, the study of teacher expectations, the study of teacher diagnostic skills in reading, the teachers' diaries of instructional activities, and the study of data available on classes previously taught by the teachers in this study. Address requests for one or more volumes to the author of this summary.

This study was conducted by a team of investigators who worked with the principal investigator and was largely responsible for the conduct of the study: Meredith Stone, William Allen, Barbara Foltin, Ruth Ekstrom, Marlaine Lockheed and David Potter of Educational Testing Service, Princeton; Patricia Elias, Patricia Wheeler, Robert Lambert, Mary Corder, and Gail Hare of Educational Testing Service, Berkeley; Nadine Lambert and Carolyn Hartsough, University of California, Berkeley; Jonathan Sandoval, University of California, Davis; Robert Calfee and Katherine Hoover, Stanford University. Patricia Elias, Patricia Wheeler and Robert Lambert were the project's Associate Directors and they directed and managed the field study. Herman Smith, Director of ETS's Berkeley Office, provided the generous support and unfailing cooperation so essential for a project of this complexity.

We wish to express our gratitude to the teachers and administrators who participated in this study. Without them there would have been no study. We appreciated the opportunity to work closely with the Evaluation of Teaching Committee (as it was then called) of the California Commission for Teacher Preparation and Licensing.

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Introduction

Phase II of the Beginning Teacher Evaluation Study (BTES) was one component in a long-term study of correlates of teaching effectiveness. The first phase was a planning and development stage conducted by the California Commission for Teacher Preparation and Licensing. The second phase was concerned with teaching effectiveness in reading and mathematics at the second and fifth grade levels and had two purposes:

1. to develop hypotheses about the relations of teaching performances to pupils' learning; and
2. to develop a measurement system that might be useful in subsequent phases of the BTES project.

The method used to generate hypotheses was, first, to measure selected aspects of pupil learning and to observe teachers in the classroom, and then, to relate statistically the observations of teaching to the measured changes in pupil learning. This method produced correlations between the observed teaching performances and the measures of learning. The significant correlations were the basis for generating hypotheses about the relation of teaching performance to pupil learning. These hypotheses are to be tested in subsequent phases of the Beginning Teacher Evaluation Study.

The second purpose of Phase II was to develop or select a variety of measures and to design a measurement system of teaching performances and pupil learning. Tests were developed or selected to assess pupils' decoding and comprehension skills in reading, their ability to apply reading skills to a variety of non-school reading materials, and their attitudes towards reading. Tests were also developed or selected of pupils' skills in mathematical computations, understanding of

mathematical concepts, ability in using concepts and computational skills in solving everyday mathematical problems, and attitudes towards mathematics.

Another important concern of this investigation was to determine the influence of a variety of factors on both pupil learning and teaching performances. Measures were developed or selected of the pupils' verbal aptitude, of their expectations for achievement in reading and mathematics, of their cognitive style, and of their background characteristics and out-of-school activities relevant to reading and mathematics. These measures assessed characteristics and experiences which the pupils brought to the classroom. This study investigated the relation of such factors to what the pupils had learned in the course of one academic year.

It is generally believed that the school environment in which teachers work will influence both what and how they teach. Important features of this environment are the support provided for innovation, creativity, and professionalism; how the administration organizes the processes for deciding about the character and substance of the curriculum; and the patterns of interpersonal relations in the school. These aspects of the teaching environment were measured and related to teaching performances.

The measurement system provided data which were used to evaluate four kinds of relations: (1) how teaching actions relate to pupil learning; (2) how pupils' characteristics relate to their learning; (3) how teachers' characteristics relate to how they teach; and (4) how the environment in which the teachers work affects how they teach. The statistical analyses of these data assessed the relative importance of these various areas and the degree and direction of the relations of specific factors to each other.

The Teachers and Schools in the Study

The study was conducted in eight school districts located throughout the State of California. They included two urban, three suburban, and three rural districts. Forty-three schools provided the sample of teachers and principals. Forty-one second grade teachers and 54 fifth grade teachers participated in the study on a voluntary basis. Their teaching experience ranged from 3 to 31 years. About 85 percent of the teachers were white, about 10 percent black, and the rest Chinese-American and Japanese-American. Twenty-five hundred pupils were included in the study.

Since the sample of teachers consisted of volunteers, it cannot be considered a random sample of California teachers. The study did not require a random sample because it was not our aim to make general statements about the effectiveness of California teachers. Rather, our goal was to identify teaching performances which, in terms of criteria of pupil learning, were relatively more effective.

Design of the Study

Data for the study were gathered during the 1973-74 academic year. During this period, pupil achievement in reading and mathematics and pupil attitudes towards reading and mathematics were measured twice, once in the fall and again in the spring. Teachers were also tested at these times. During the intervening period, three to eight observations were made of each of the teachers in their classrooms. Teachers were also videotaped on one or more days during reading and mathematics

instruction. Additional information on the instructional process was collected directly from the teachers by having them complete "Work Diaries" for two different weeks during the school year. Principals completed questionnaires and were interviewed about their schools' programs and teaching environment.

The Measurement of Pupil Characteristics

The California Commission for Teacher Preparation and Licensing specified the kinds of pupil learning which should be the object of investigation in this study. These were reading (decoding, comprehension, applications, and attitudes towards reading) and mathematics (computations, concepts, applications, and attitudes towards mathematics). We used the curriculum goals of the State of California to define the specific objectives for each of these subjects. These statements of objectives in relation to the major areas were reviewed and approved by the Commission. Tests to measure pupils' achievement of these objectives were built specifically for the purposes of this study. The California Achievement Tests in Reading and Mathematics, 1970 Edition,[1] and the Short-Form Test of Academic Aptitude (1970)[1] were also used. A measure of cognitive style[2] was used that assessed the degree to which each pupil's characteristic perceptual and cognitive mode was analytic or global. Information was collected from parents and teachers about a variety of student characteristics.

The pupil tests were administered during a two-day session in the fall and in the spring. The test administrations were conducted by

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[1]Published by CTB/McGraw Hill, Monterey, California.

[2]Forms of the Embedded Figures Test, Consulting Psychologists Press, Palo Alto, California, 1963-71.

trained substitute teachers; we provided monitors to facilitate the test administrations. The testing was conducted in each classroom. The tests had been pilot tested to assure their suitability for second and fifth grade pupils.

Observations of Classroom Teaching and Pupil Activities

Systems were developed to describe teaching performances by direct observation of classroom teaching actions and activities. The observation systems were designed to gather data on the ways teachers organized pupils for instruction, the types and variety of materials they used in instruction, the interaction of the teachers with pupils during instruction, and the specific content of instruction. The possible effects of being observed on the instructional process is difficult to ascertain, but does not invalidate the results of this study since we were looking for effective teaching practices rather than typical teaching practices.

Two systems of observation were used in each classroom. One system, APPLE (Anecdotal Process for Promoting the Learning Experience),[3] required an observer to write down behavioral statements of what the teacher and pupils were doing. These statements were subsequently coded by independent coders and organized into categories. This system had been developed and refined over a period of several years in California classrooms.

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[3]Developed by Nadine Lambert, University of California, Berkeley, 1970. Described in Volume III.1.

The other system, RAMOS (Reading and Mathematics Observations System),[4] was developed originally by intensive observation of reading teachers and was extended to cover observations of mathematics instruction. In its development, detailed behavioral recordings were made of what teachers did during a teaching period and these observations were organized into categories. This resulting category system was used for observations in this study.

The observational data were reorganized into more comprehensive categories of teacher and pupil behavior during reading and mathematics instruction. The larger categories described the teaching contexts, the instructional activities, the variety of instructional goals and materials, and the techniques of instruction. Each such category contained subcategories which described the variations in teaching activities and actions observed. For example, the category teaching context described how the teacher organized the class for instructions--in groups, with the class-as-a-whole, or with each pupil working independently. Teaching activities described how instruction was given--by questioning, explaining, discussing, or monitoring independent reading or the working of problems.

The videotapes provided another way to collect information on what was happening in the classrooms during reading and mathematics instruction. All teachers were videotaped on one to four occasions. The videotapes were coded using a modified version of the APPLE observation system.[5]

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[4] Adaptation of Reading Diary by Robert Calfee and Kathryn Hoover, Stanford University, 1972. Described in Volume III.2.

[5] Developed by Jonathan Sandoval, University of California, Davis, 1974. Described in Volume III.3.

The teachers provided diaries of their activities for two separate weeks of teaching. These Work Diaries were developed in consultation with the teachers. In the diaries, the teachers described the direct teaching time, the variety of skills taught, the complexity of a teacher's conceptualization of instructional design, the variety of instructional contexts (classroom organization), and the variety of instructional materials.

All of these sources of data provided information on each teacher. Together they allowed the description of the patterns of a teacher's classroom activities.

The Measurement of Teacher Characteristics

Teachers' knowledge, aptitudes, and attitudes were also measured. The tests of knowledge were of two kinds: knowledge of the subject taught (reading and mathematics) and knowledge of teaching methodology. Two attitude measures were used, one pertaining to attitudes towards the teaching of reading, the other to attitudes towards the teachirg of mathematics. The teacher aptitude battery included measures of verbal and mathematical aptitude, organization of information, reasoning, and a measure of cognitive style which, like the pupil measure, assessed whether the teacher's perceptual and cognitive style was analytical or global in character. About one-third of the teachers took a videotaped test of their ability to diagnose reading problems and to prescribe corrective actions.

Teachers' expectations for their pupils' achievement in reading and mathematics were measured by asking the teachers to rank-order each pupil with respect to standing in reading and in mathematics.

Information was collected from the teachers on their own family background, education and teaching experience, aspirations for and satisfactions with teaching, and their preference for teaching pupils with different kinds of home, community, and ability characteristics.

The wide variety of instruments was used to allow the investigation of many kinds of relationships between teacher characteristics and teacher performances in the classroom. Presumably such stable characteristics as aptitudes influence how a teacher perceives, organizes, and interacts with pupils while teaching. Similarly, teachers' expectations for how pupils will learn and what they will accomplish might influence how they teach each pupil and the class. Teachers' attitudes toward reading and mathematics and their knowledge of these subjects presumably also influence how they teach.

The Measurement of the Characteristics of the Teaching Environment

Information was gathered from the principals and teachers on characteristics of each school and on the teacher-principal relations as perceived by both the teachers and the principals. Each teacher and principal completed a scale measuring characteristics of the organizational climate.[6] The teachers also responded to a questionnaire about their participation in curriculum decisions and decisions pertaining to instructional methods.[7]

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[6]Teacher and Principal Forms of Profile of a School, Rensis Likert and Associates, Inc., Ann Arbor, Michigan, 1971.

[7]Adaptation of form developed by the staff of the Environments for Teaching Program, directed by Elizabeth G. Cohen, Stanford Center for Research and Development in Teaching, Stanford, California (NE-C-00-3-0062).

Each principal responded to a questionnaire about the school. Questions were asked about the organization of the staff, the programs, the goals of instruction, teaching methods and materials, and the district's support for innovation and experimentation. Each principal was also interviewed about how instructional and curricular decisions were made in the school and his or her goals and problems.[8]

This information was organized into categories which described support for innovation, organizational structure, principals' perceptions of organizational climate, and teachers' perceptions of the organizational climate.

Analysis of Data

The purposes of the analyses were first, to determine if the effects of teaching were significant--did teachers make an appreciable difference in how much pupils learned--and second, to isolate those aspects of teaching which were producing these effects--which teaching activites and actions accounted for greater gains in pupils' learning.

The results of these analyses were of two kinds. First, they describe which teaching acts and activities were associated with greater gains in pupils' learning. These associations formed the basis for hypotheses which may be tested in subsequent phases of the study. Second, the testing of a structural model (see Figure 1) enabled us to estimate what kinds of variables were likely to influence teaching

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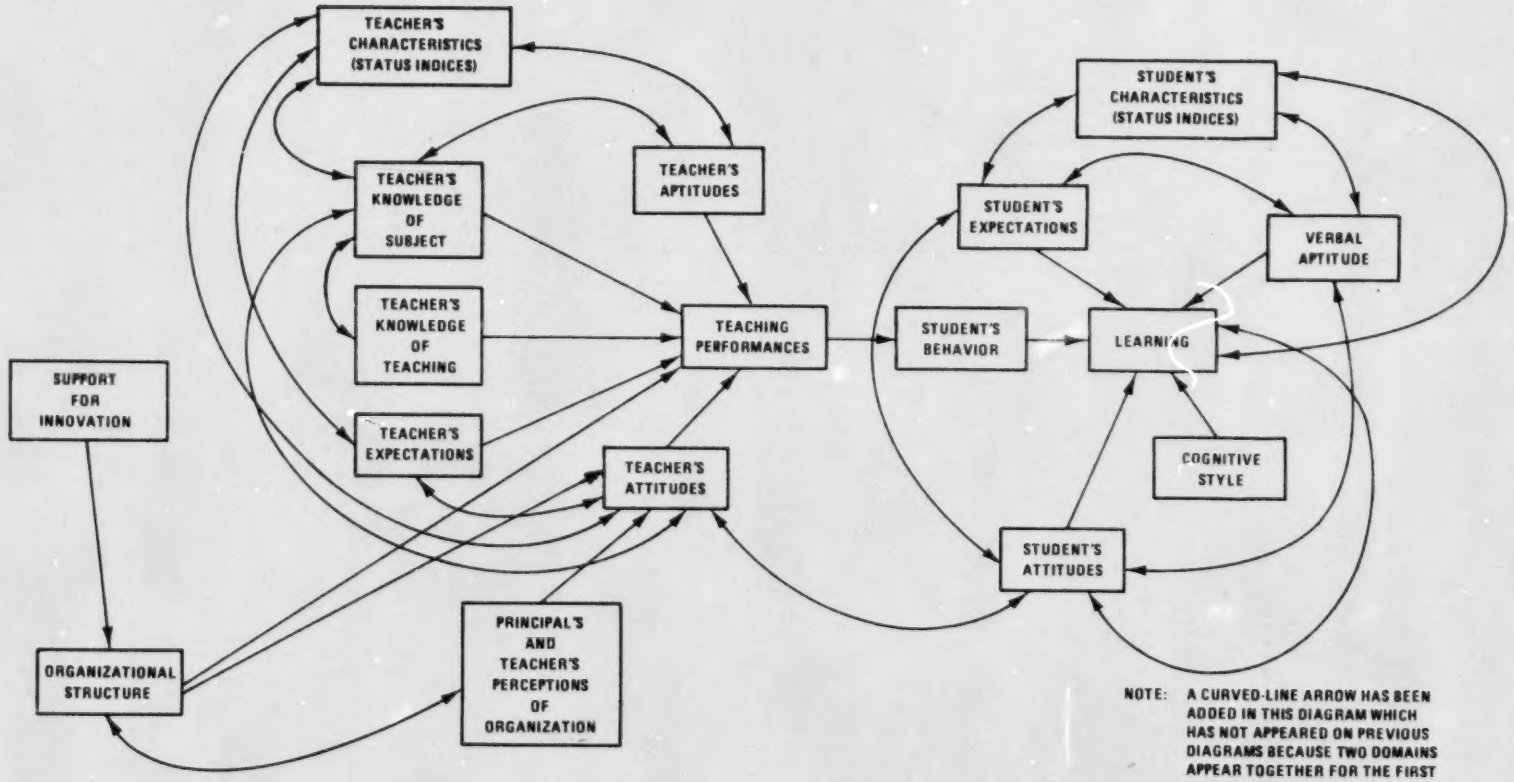
[8]Forms for this interview were developed by the staff of the Environments for Teaching Program, directed by Elizabeth G. Cohen, Stanford Center for Research and Development in Teaching, Stanford, California (NE-C-00-3-0062).



NOTE: A CURVED-LINE ARROW HAS BEEN ADDED IN THIS DIAGRAM WHICH HAS NOT APPEARED ON PREVIOUS DIAGRAMS BECAUSE TWO DOMAINS APPEAR TOGETHER FOR THE FIRST TIME IN THIS DIAGRAM. A CURVED-LINE ARROW HAS BEEN DRAWN BETWEEN TEACHER'S ATTITUDES AND STUDENT ATTITUDES. STUDENT BEHAVIOR IS REPRESENTED FOR THE FIRST TIME IN THIS DIAGRAM.

Figure 1. A Structural Model of the Domain of Variables Influencing Teaching Performances and Children's Learning

performances. This information may be used to design more sophisticated models for future research. The testing of a model of this kind contributes to the development of a theory of teaching by suggesting what variables should be included in such theories and by examining relations among these variables.

The Results of the Study

The results of this study were of several kinds. First, it was possible to answer some general questions about the nature of teaching in the elementary school. Second, we were able to identify some teaching practices that were more effective than others.

Although common sense and practical experience suggest otherwise there is a widespread belief that the home and community environment of the pupil has such a powerful influence on what a child has learned or will learn that schools and teachers make a very small difference, if any. It has been claimed on the basis of some studies that the socio-economic background of the pupils "explained" more of the growth in pupils' learning than any other factor.[9]

One of the most important results of this study is that the data show that teachers do make a significant contribution to pupils' learning. In the analysis of the data, the factor most strongly related to a pupil's final scores was the initial scores, which was to be expected. In general, pupils who read better at the beginning of the year were still the better readers at the end of the year. But in

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[9] Christopher Jencks, et al. Inequality: A reassessment of the effect of family and schooling in America. New York: Basic Books, 1972.

this study, we found that the second most important factor contributing to change was what teachers did. Practically, what this result means is that a pupil might make considerable progress during the year, more progress in fact that would have been expected on the basis of how skillful he or she was at the beginning of the year. Such changes occurred with pupils whose initial scores were low, or low compared to his or her classmates, as well as with pupils who were above average or better in reading or mathematics. The two best predictors of how much change will occur in reading and mathematics are the pupil's level of skill at the beginning of the year and the kinds of instruction and teaching he or she receives. Teachers do make a difference.

Another common belief among some investigators of teaching is that there are basic teaching skills which are needed by all teachers. Everyone recognizes, however, that teaching in the elementary school differs from teaching in the high school because the pupils are at different stages of development and experience. Also it is usually accepted that teachers vary their approach to individuals in terms of each pupil's interests and abilities. But despite these obvious and significant qualifications, there is a view that a basic set of skills is needed in most teaching situations.

One of the most important results of this study is that no single skill or teaching practice was found to be effective at both second and fifth grade and in teaching both reading and mathematics. At the fifth grade, for example, teaching the class-as-a-whole in mathematics was an effective practice, but it was not effective in teaching reading at the fifth grade and in teaching both reading and mathematics at the second grade.

The results also provide data to support the hypothesis that it is patterns of practices rather than single teaching practices or teaching skills which account for effectiveness. For example, the teachers in the study used a variety of ways of organizing pupils for instruction. The three typical patterns were working with an individual pupil, teaching a group, and teaching the class-as-a-whole. Some teachers consistently use one of these ways of organizing instructional groups; others use a mixture of them. Our results suggest that no one method of classroom organization is consistently effective at both grade levels and in both reading and mathematics.

The critical feature in organizing instruction seems to be the degree to which the procedure facilitates managing the instructional process and maintaining a reasonably high level of pupil involvement. Appropriate material is not sufficient. Patterns of classroom organization and teaching performances which provide more direct instruction to pupils by teachers improve pupil learning.

The data also indicate that considerable time spent in organizing for instruction rather than in instructing is an ineffective use of instructional time. A teacher must spend time organizing and managing instruction, but when more time is spent in management, there is less time for instruction. Beyond a certain point, time spent in organizing becomes ineffective.

Promising Teaching Practices

In putting together the results we identified some promising teaching practices which appear to be related to growth in pupil learning. These practices should be regarded as hypotheses which will

be tested in future research, but teachers might want meanwhile to try some of the ideas in their classrooms. However, teachers should remember that a major finding of this study is that teaching performances which enhance pupil learning differ for both grade level and subject area.

There is a theme in these "promising teaching practices": if a classroom organizational structure or a teaching performance provides for direct instruction by the teacher, learning will be improved. The critical problem is not whether a teacher teaches in a group; it is whether such teaching provides direct instruction to pupils. When a particular teaching practice is found to be ineffective, it should be examined to find out what is missing from the process of direct instruction.

Second Grade Reading

Second grade reading is devoted typically to learning basic decoding skills and to learning the rudiments of reading comprehension. The pupils frequently differ considerably in how much decoding skill they have acquired. Consequently, teachers organize instruction to accommodate these differences. One sees much independent seatwork and teaching of small groups at this grade level.

Our data suggest that this pattern of instruction is most effective when it contains the following elements: (1) each pupil's access to the teacher for instruction or for correction of work is increased as much as possible; (2) when the teacher works with an individual pupil or with a small group, other pupils continue to work on their reading tasks; and (3) a variety of materials is used. Unmonitored seatwork or arrangements that keep pupils waiting for instruction is

ineffective. The model to be implemented is one like the tutorial model, except that the teacher must cope with instructing all pupils in the classroom.

These results seem to be consistent with what we know about how basic skills are learned. The skill must be demonstrated or practiced and the pupil must know when he or she is making errors. The teacher, for example, may model a correct sound or have the pupils practice it, correcting them as they produce the sound. The more this kind of instruction is provided for each pupil, the greater the learning for the group.[10]

Second Grade Mathematics

The pattern of effective practices in teaching second grade mathematics is similar; the tutorial model is effective. Here too the pupil is learning fairly discrete operations, and his or her skill in them and understanding of concepts increase in proportion to the degree that the pupil practices the operations and receives correction of his or her work. More direct instruction with demonstrations and explanations facilitates learning. The number and variety of mathematical skills taught relate to how much pupils learn.

But using a variety of materials in second grade mathematics is ineffective. We are not sure why this is so, but here are our speculations. The content to be learned is largely the concepts and algorithms or arithmetical combinatorial processes. Understanding of the concepts beyond a certain point depends on being able to perform

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[10] We are describing a general model. Obviously it is impossible to approve or correct everything, and for some children such processes must be managed delicately.

the algorithms, and performing the algorithms correctly depends in part on grasping the basic concepts. Probably an orderly sequence of problems from simple to complex facilitates grasping the concepts and operations. The use of a variety of materials may disrupt this order or introduce extraneous ideas, or the materials themselves may not be appropriate to what the pupil needs. We assume that the teacher will usually be able to assign the materials according to what the pupil needs; so we think that the materials may be either extraneous with regard to what is to be learned, or marginally relevant, or that they break up a logical sequence of presentation of the content.

Fifth Grade Reading

During fifth grade reading instruction, greater emphasis is usually placed on reading comprehension, and the pupils are asked to read more complex material. These reading materials require the use of complex cognitive processes such as analysis and evaluation to comprehend them to the fullest. The teacher's task is, therefore, to stimulate a higher level of thinking about the reading material.

Teaching practices which provide for sustained interactions with pupils are more effective for teaching fifth grade reading. Such practices include conducting discussions, giving explanations, and sustained questioning and answering. The use of a variety of materials was not effective, which contrasts with effective practices in teaching second grade reading. In fifth grade, the teacher-pupil interaction must be more sustained around fewer materials. The teacher thinks with the pupil about what he or she has read, what it means, and how it relates to other ideas.

Fifth Grade Mathematics

At the fifth grade in mathematics, both teaching in small groups and teaching the class-as-a-whole are effective classroom organization practices for pupil learning. Also, varying the small groups and class-as-a-whole arrangements is an effective instructional pattern. But an instructional arrangement is not likely to be effective by itself. Presumably by the fifth grade a child has mastered or been familiarized with the basic mathematical operations. The emphasis in fifth grade mathematics is on concepts and problems and the operations being learned are variants on operations learned in the earlier grades. The pupils may not need as much direct instructions on concrete specific operations.

The use of a variety of materials in teaching fifth grade mathematics is an ineffective practice. We think that the reasons for this result are probably the same as those we offered for a similar result obtained for second grade mathematics.

Pupil Attentiveness and Teaching Effectiveness

Teachers are interested in the relation of pupil attentiveness and productive work to learning. The observations included information about on-task attentive behavior, inattentive behavior, and productive work of pupils.

Pupil behavior that was inattentive or unproductive was frequently associated with less pupil learning. But pupil attentive behavior related to learning only for fifth grade mathematics instruction and, there, more observed attentiveness was related to less pupil learning.

Pupil productivity (the demonstration of appropriate skills by pupils during reading and mathematics instruction) related to better learning in second grade reading. Productivity, however, was associated with poorer learning for fifth grade pupils. Pupil productivity also varied with the classroom organization practice so that teachers, for example, who used groups more often generally had better pupil productivity and pupil attentiveness in their classes.

Inattentive behavior relates to less learning. Attentive and productive behavior, however, may be necessary but not sufficient to produce learning. The results suggest that pupil productivity and attentive behaviors may be complex phenomena which relate to the maturity level of the pupil, what is being taught, and how it is being taught.

Influences on Teaching Performances

There were also major findings about conditions of teaching or characteristics of teachers that affect teaching performances. Those that kept reappearing in the analysis and could be considered recurrent themes included the following four findings.

First, the nature of the decision-making processes in the school is a predictor of the teaching styles in that school. Centralization of decision-making related to several kinds of teaching practices. It was often associated with the ways pupils were organized for instruction. One example may illustrate some of the interesting relations. For teaching second grade mathematics greater centralization of decision-making was associated with less independent pupil seatwork and teaching in groups and more teaching the class-as-a-whole was

observed; teaching the class-as-a-whole, however, was a negative predictor of pupil learning in second grade mathematics. We suspect that the less effective classroom organizational strategies may be thought of as "better" ways of teaching by both teachers and principals.

It is also interesting to note that teaching in groups and teaching the class-as-a-whole were associated with greater pupil attentiveness or productivity. Pupil attending behavior is usually thought of as an indicator of "good" teaching. It may be that in schools characterized by centralized decision-making, the prinicipal rewards order and attention, which would mean that teachers would be more likely to engage in those performances which produce a higher level of attention. The decision-making variable may be related to rewarding order, but it may not be related to effectiveness of instruction.

Second, at both grade levels and in both reading and mathematics, the teacher-aptitude scores produced the largest number of significant relationships to teaching performances of any group of variables included in the study. The results supported the generalization that teaching performances may be a direct function of teacher aptitudes as we broadly defined them in this project. For example, higher scores of flexibility are related to teaching the class-as-a-whole in second grade mathematics instruction. We think that this type of teaching probably does require greater flexibility since the teacher must process a wider variety of perceptual-cognitive information more or less simultaneously. Teachers who are more flexible are probably more able to teach the whole class, and if they believe that it is a more effective way to teach and want to teach better, then they use this instructional context more frequently. Our data, however, suggest

that this practice is less effective than one approaching the tutorial model for teaching second grade mathematics.

A third finding of this study is that knowledge of teaching methodology and of reading and mathematics appeared to relate to teaching performances, probably in combination with a teacher's characteristic perceptual and cognitive style. For grade two reading instruction, the knowledge measures were negatively related to classroom organization strategies that placed greater demands on knowledge, such as teaching the class-as-a-whole, but were positively related to strategies where the teacher presumably has greater control over the knowledge demands placed on him or her, such as teaching a group.

And a fourth finding is that measures of teachers' attitudes and aspirations were associated with certain aptitudes and certain teaching practices. There appeared to be distinctive combinations of aptitude, attitude, and performance. These combinations may be the factors which truly distinguish among teachers. They may be a way of defining distinctive teaching styles, a concept that seems to have meaning but until now has defied even modest precision of measurement.

If the fourth finding listed above is valid, then an important question is whether these styles are modifiable. Studies of the modifiability of teaching performances will be necessary to determine which policy alternative--selection or training--is more likely to be appropriate in identifying potentially effective teachers. The strong relations between aptitude and teaching performance suggest that methods for educating teachers should be adapted to their individual aptitudes.

Summary

There are several general conclusions which emerge from all the analyses that were performed. These conclusions relate to questions which have been of interest for some time in research on teaching. The history of research on teaching has been characterized by the attempt to find general teaching skills which significantly influence learning. Did we find any single teaching skill which significantly correlated with learning in both reading and mathematics at both grade levels? No such skills were found.

It is important to emphasize that the data describe characteristic styles or predominant modes of teaching. We believe that the results of this study suggest which styles or components of styles are likely to be effective or ineffective. It is these combinations of teaching performances rather than any single performance that account for the effectiveness of instruction.

The general picture that emerges from these data is one which has two features; first, a pattern of teaching practices is more likely to be related to learning than a single practice and, second, effective teaching patterns will differ by subject matter and by grade level.

The second of these conclusions, if replicated or found in comparable studies, is an important one. The practical implications of such a conclusion are obvious; the goals of training teachers in the primary grades and the intermediate grades and for different subject areas will be necessarily different.

Perhaps the most important general conclusion from the study is that teachers do make a difference in how well their pupils learn. In this as in other studies the skills a pupil brought to a classroom were a large determinant of how much they learned. But when the entry-level skills of pupils were "accounted for" statistically, the remaining differences in pupil learning were almost all accounted for by differences among teachers in how they taught.